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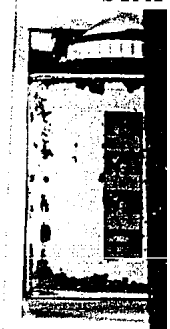

NEW TYPES OF SHIPS FOR THE GREATER VOLGA RIVER

[Comment: This report presents extracts from the book Suda Novykh Tipov dlya Bol'shoy Volgi (Ships of New Types for the Greater Volga River) by A. P. Strakhov, published in Moscow in 1954.]

In connection with the construction of hydroelectric power projects on the Volga River and the creation of attendant reservoirs, the Soviet Union has taken steps to design and construct river vessels which will be able to cope with navigation conditions encountered on the altered river channel. These new types of ships may be divided into six different groups: passenger ships, tugs, pusher tugs, self-propelled cargo ships, unrigged cargo ships, and river icebreakers.

PASSENGER SHIPS

The basic characteristics of the four most widely employed passenger ships are shown in the following table:

Index	450-hp Paddle-Wheel Steamer	800-hp Diesel-Electric	1,200-hp Diesel	2,700-hp Diesel-Electric
Length over-all (meters)	71.4	79.7	96.5	121.4
Length between perpendiculars (meters)	68.4	76.0	90.0	116.0
Breadth over-all (meters)	15.7	12.2	14.7	16.8
Molded breadth (meters)	8.0	9.6	11.6 on deck 12.0	12.4
Height amidships (meters)	2.6	3.16	4.3	5.0
Mean loaded draft (meters)	1.2	1.95	2.2	2.2
Power at electric driving motors	--	About 500 kw	--	2,250 bhp
Speed in deep water (km/hr)	20.0	19.2	Up to 23.0	26.0
Over-all passenger capacity	350	302	369	466
Cargo dead-weight (tons)	20.0	80.0	70.0	120
Type of cargo	Passenger baggage	General cargo	Perishable cargo	Perishable cargo and baggage
No of crew (including porters and restaurant personnel)	50	48	72	84

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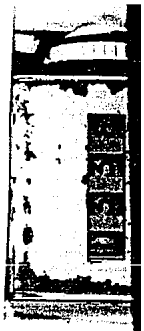


Steam Paddle-Wheel Passenger Vessel, Capacity 450 Indicated Horsepower

The Iosif Stalin was the prototype of the river paddle-wheel passenger steamer with a capacity of 450 indicated horsepower. This was the first passenger steamer with a two-decked superstructure, and was designed and built by the Leninskaya Kuznitsa Plant.

The ship's hull is of metal and all welded, including metal decks. The superstructure bulkheads on both upper decks have metal all-welded shells.

All auxiliary machinery is steam driven. In deep water the Iosif Stalin reaches a speed of 20.2 kilometers per hour, which exceeds design speed.

Diesel-Electric Passenger Vessel, Capacity 800 Brake Horsepower

The passenger diesel-electric ship with a capacity of 800 brake horsepower is represented by the diesel-electric Rossiya which went into service in the last days of the 1952 navigation season. These ships are twin screw with diesel-electric drive and were built for navigation under reservoir conditions. The main engines are composed of two four-cycle, nonreversing diesel engines operating on the generators, and two auxiliary diesel generators for operating auxiliary machinery. All auxiliary machinery is electrically driven.

Diesel Passenger Vessel, Capacity 1,200 Brake Horsepower

The passenger fleet has been significantly augmented by diesel passenger ships with a capacity of 1,200 brake horsepower and accommodations for 369 passengers. The Motor Vessel Rodina is characteristic of this type of vessel. This ship was designed as a new vessel for the basic transit lines of the Volga fleet.

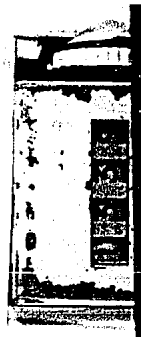
Hull framing in these vessels is mixed, with a transverse system used for side framing and a combined longitudinal and tranverse system used for bottom and main deck framing.

The main and middle deck plating, as well as the awning deck over the upper superstructure, is completely metal. The upper deck has metal plating in all open areas, around the heads, and around the holds. The inside superstructure plating is of wood. While the superstructure on the main deck is all metal, the superstructure of the middle and upper deck is a combination of a metal frame sheathed with wood. The ship is constructed under Division O of the USSR Register with reinforcement of the hull for navigation in light ice.

"Tekstovinit" [presumably a vinyl baseboard with textile material reinforcement] is used for partitioning in the captain's cabin, the crew's dining salon, and other compartments. Composition board has been used for partitioning in cabins, heads, and social compartments in the vessel. Bakelite plywood is used for main bulkheads in the heads and galley, and for external plating of the wooden superstructure on the middle and upper decks.

The ship's main engine plant is composed of three diesel engines (with a capacity of 400 brake horsepower at 500 revolutions per minute) working on three steel propellers.

The ship carries a marine electric power station composed of three diesel generators (alternating current) with a capacity of 75 kilowatts each and one alternating current diesel generator of 25 kilowatts. There is also an emergency diesel generator with a capacity of 12 kilowatts.



All of the ship's equipment, such as the steering engine, anchor windlass, winches, pump, etc., is completely electrified.

The ship incorporates the following new elements: (1) ice reinforced hull; (2) refrigerator equipment for a cargo hold; (3) a sonic depth finder for water depth measurements; (4) the wide use of new construction, insulation, and partitioning materials (wood sheet, bakelite plywood, metallic matting, and others); (5) the covering of metal decks with nonskid mastic; (6) fluorescent lighting of passenger quarters; (7) sound insulation of compartments with the use of an amortizer in the diesel foundation for eliminating noise; (8) installation of a marine automatic telephone exchange; (9) a wired radio center with separate systems for the crew and the passengers; (10) electrified galley equipment; (11) the adoption of fireproofing paint for the walls of the engine room and metal parts of the hull which are above the water line; (12) fireproofing impregnation of all wood used; (13) forced ventilation of all compartments; (14) hot and cold running water in all passenger and crew compartments; and (15) mechanization of cargo operations with the aid of electric telphers.

Diesel-Electric Passenger Vessel, Capacity 2,700 Brake Horsepower

This is a new type of three-decked, three-screw passenger ship with metal welded hull. The ship accommodates 468 passengers in comfortable single, double, three-place, and four-place cabins.

The deck and hull bottom have a transverse framing system, while amidships a longitudinal-transverse system framing is used. The sides employ a transverse framing system throughout the length of the vessel.

The hull is all welded, using low alloy steel mark SKhL-1.

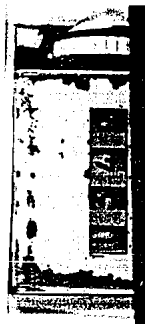
The over-all hull strength was verified during tests on waves measuring 3 x 40 meters. The vessel fully complies with the requirements of the Register for ships of Division O.

Tests on self-propelled models in a test basin indicated that at a permissible capacity the speed of the vessel in deep water would reach 26 kilometers per hour.

The superstructure of the ship has all-metal bulkheads with inside wood sheathing. The superstructure will have the special feature of individual compensators which will make it possible for the superstructure to expand and contract in relation to temperature and movement of the vessel on waves. The bulkheads of the superstructure can be repaired in a plant which produces all-metal railroad cars. Production technology includes the welding of sections 10 meters long. Sections with already prepared window and door frames will be carried to the plant and welded into a single superstructure directly on the hull of a ship lying in the building slip.

The ship has a refrigerated hold for transport of 100 tons of perishable cargo and a hold for transport of 20 tons of passenger baggage.

While checking maneuverability of the vessel during model trials in the basin, it came clear that when moving ahead themodle's three rudders provided excellent maneuverability, but when under way astern the vessel could not be handled with these rudders. Turning cowls on the screws also failed to give the desired effect. For the first time on river ships, therefore, in addition to the rudder installation, a so-called subrudder assembly (podrulivayushcheye ustroystvo) was installed. These installations were placed both in the forward and after sections of the ship and ensure maneuverability when under way astern.



The subrudder assembly operates on the principle of the reaction of streams of water from a propeller pump of the reversing type directly connected to the shaft of a two-cycle electric motor. The capacity of the electric motor is 75 kilowatts at 720 revolutions per minute and 180 kilowatts at 965 revolutions per minute.

According to data from model tests, with the aid of this installation the vessel can even turn a circle around its own axis when operating at low speeds (up to 12 kilometers per hour). The diameter of the turn when turning on two rudders was about 2.5 ship lengths, and the turning circle when utilizing the turning cowls was about 1.5 ship lengths. When operating the subrudder assembly installation, the force (reaction) perpendicular to the plane of the ship reached 1,000 kilograms at a motor capacity of 75 kilowatts and 1,500 kilograms at a capacity of 180 kilowatts.

The main engine installation of the vessel is composed of three D50 diesel generators. The generators are direct current with a capacity of 700 volts.

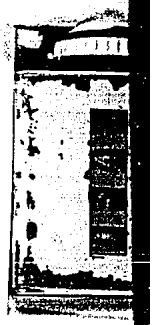
Three main engines are necessary to handle the vessel's three propellers. With the three propeller shafts operating from independent electric motors with a capacity of 750 horsepower each, the diameter of the propellers made it possible to build the hull without funnels.

It is planned to install two 600-brake-horsepower (at 1,000 rpm) engines for the ship as auxiliaries. To ensure electric power when the ship is standing without passengers, a spare engine is carried, with a capacity of 150 horsepower at 1,500 revolutions per minute. In case of emergency, the ship carries a second emergency engine with a capacity of 20 horsepower, with hand starting for operation of the radio and lighting.

All auxiliary machinery on the ship is electrified.

This ship incorporates the following new elements: (1) the adoption of three-level metal superstructure and platform in the hull with four-level location of compartments; (2) the adoption of compensators for the superstructure; (3) special attention to the architectural form of the ship; (4) wide use of latest insulating and compartmental materials; (5) the use of three propellers with three shafts; (6) the adoption of a subrudder assembly for maneuvering the vessel; (7) the use of the latest instruments and automatic equipment for vessel handling, including sonic depth finder, radar, etc.; (8) the use of daylight fluorescent lighting for passenger compartments; (9) the installation of maximum comforts for passengers in all compartments; (10) the construction of a solarium on the upper deck and a motion-picture theater for passengers; (11) fireproofing of wooden elements used in construction; (12) the use of fireproof broad metal bulkheads; (13) the use of air-conditioning and forced ventilation.

The passenger ship types described above do not represent all types of passenger ships required for inland navigation in the USSR. At present, passenger ships of several types are being designed and built. These include passenger diesel vessels for local navigation, cargo-passenger diesel vessels with possibilities for navigating in and out of large lakes, and so forth. The following paragraphs describe two such types of ships. Their basic characteristics are as follows:



Index	Lake Diesel Vessels	
	300-hp Passenger Ship for Local Lines	800-hp Cargo-Passenger Ship
Length over-all (meters)	42.35	65.0
Length between perpendiculars (meters)	40.60	62.0
Maximum breadth (meters)	7.1	12.0
Molded breadth (meters)	6.0	9.4
Depth amidships (meters)	2.5	3.7
Mean loaded draft (meters)	1.44	1.9
Assured speed in deep water (km/hr)	20.4	22.5
Over-all passenger capacity	271	365
Dead weight (cargo) (tons)	--	30
Type of cargo	--	General cargo
No in crew	10	40

Passenger Lake Diesel Vessel, Capacity 300 Brake Horsepower, for Local Lines

In the fall of 1952, a prototype of a 300-brake-horsepower passenger diesel vessel was put into operation for local communication. This vessel was designed for operation in lakes, reservoirs, and basins where conditions of navigation corresponded to the requirements of the Registry described for ships in Division O. Results of experience indicate that the speed of the ship exceeds 20 kilometers per hour.

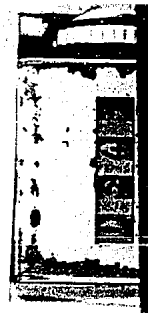
This diesel vessel is intended especially for transporting passengers on short runs in reservoir conditions with the voyage lasting 4-6 hours.

Such vessels, the first series of which were put into operation in 1953, will sail on local passenger lines on the Tsimlyanskaya, Rybinsk, Kuybyshev, Stalingrad, and other reservoirs.

In the future, ships of this type will be built with the stern part of the main deck closed. Vessels of this type can also be adapted for longer voyages by building a second variant with sleeping compartments for passengers.

The hull of this vessel is constructed on a transverse framing system with floors at each frame.

The vessel carries two 150-horsepower 3D6 engines which can be started electrically from the bridge or from the engine room. The vessel is driven by two steel screws. For electric current the ship carries a direct-current generator driven from the main engine. Starting, reversing, and controlling of speed to the main engines can be effected remotely from the bridge.



Cargo-Passenger Lake Diesel Vessel, Capacity 800 Brake Horsepower

Ships of this type are designed for transport of transit passengers and general cargo on water routes appropriate to Division M of the Register. They may operate on such open lines as Kherson-Nikolayev, on Lake Ladoga and Lake Onega, in the Gulf of Finland (to Vyborg), at the mouths of Siberian rivers, and on Lake Issyk-Kul'.

The hull system is mixed, being longitudinal at the bottoms and decks and transverse at the sides.

The ship has remote centralized control of the engines from the bridge and all auxiliary machinery on deck and in the engine room is electrified.

In addition to the ships described above, paddle-wheel passenger steamships with a capacity of 250 indicated horsepower should also be noted. These are suitable for navigation in small rivers or in back waters where navigational depths are reduced by water route construction.

Steamships of this type are either one- or two-decked (depending on route conditions) with hull dimensions of 57.6 x 7.0 x 2.4 meters, a mean draft of 0.9 to 0.95 meters, a passenger capacity of 200 and 250 passengers, and a dead weight of 20 tons of baggage. Construction of passenger screw diesel vessels with a capacity of 150 brake horsepower of the Moskvich type will be continued. These diesel vessels are operating at present in city and suburban lines in a great number of cities, such as Moscow, Leningrad, Kiev, Riga, Rostov, Gor'kiy, Stalingrad, Kuybyshev, and Novosibirsk.

TUGS

A great deal of work was done in building new types of tugs for inland navigation. The first of them in the postwar period were the paddle-wheel steam tugs, with capacities of 400 and 200 indicated horsepower, built in large series.

In comparison with the best of the old Volga paddle-wheel tugs, the new steam tugs are vastly improved. In the first place, the towing quality is much higher. Towing force per horsepower goes as high as 14.3 kilograms, which significantly exceeds the towing quality of the majority of existing paddle-wheel tugs.

The new paddle-wheel tugs are equipped with inclined steam engines, with capacities of 400 and 200 indicated horsepower, and water tube steam boilers with heating surfaces of 160 and 85 square meters.

The construction of hydroelectric projects on the Volga and the correspondingly improved navigational conditions created thereby place before shipbuilders the task of building screw tugs of newer types. In diesel and steam vessels, equipment for increased towing qualities are incorporated, as well as the most economical machinery; i.e., internal combustion engines for diesel vessels and vertical steam engines with increased steam parameters for steamships.

At present, one of the basic types of diesel tugs for the Volga is the twin-screw diesel vessel with a capacity of 600 brake horsepower built according to the design of the Central Design Bureau at the Krasnoye Sormovo Plant imeni A. A. Zhdanov. Series production of these vessels began in 1948.

This tug is the most widely distributed type of screw-driven towing vessel and is representative at present of the new tug fleet on rivers of the USSR.

A new type of screw lake-river steam tug is the BOR-450, designed for operations even into open maritime roadsteads (Division Ma of the Register, USSR).

Completion of this type was preceded by the construction of river screw steam tugs with a capacity of 400 indicated horsepower and a draft of 1.4 meters. These vessels were begun in 1949. The prototype of this ship was called the Akademik Timiryavev. However, the limited draft on these ships did not permit designers to obtain very high towing strength from them. Therefore, it was decided to try operation of these river ships in different navigation conditions, significantly increasing the vessel's draft and with it its towing characteristics. A later type of screw tug, designed for transit towing of ships in Division O of the Register, USSR, is the twin-screw lake diesel tug with a capacity of 800 brake horsepower.

The tugs of the types discussed and their basic characteristics are shown in the following table.

Index	Rated Capacity (hp)		
	600	450	800
Length over-all (meters)	40.3	43.3	48.4
Length between perpendiculars (meters)	37.2	41.0	46.0
Molded breadth (meters)	7.40	8.0	9.0
Depth amidships (meters)	3.0	3.2	3.2
Mean draft with full fuel load (tons)	1.8	2.2	2.2
Capacity of main engines (hp)	2 x 300	2 x 225	2 x 400
Towing force at hook (kg) (at speed of 8 km/hr)	7,000	6,000	9,500
Tug speed without tow (km/hr)	18.0	19.0	18.0

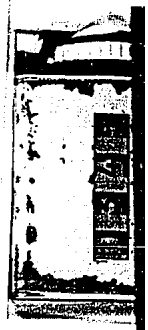
Two-Screw Diesel Tug, Capacity 600 Brake Horsepower

The metal hull of this tug with transverse system framing is entirely welded and built by the sectional method from enclosed and flat sections. The superstructure of the living and service compartments is also made of enclosed sections welded from 3-millimeter-thick metal.

The engines work directly on the screws. Auxiliary engines operate generator and compressors. All auxiliary machinery and installations (windlass, rudder engine, towing winch, etc.), as well as the auxiliary machinery in the engine room are electrified.

The stability of the ship corresponds to the requirements of Division O of the Register, USSR. The strength of the hull is calculated for navigation in light ice.

The vessel has accommodations for a crew of 21 men (6 officers and 15 crewmen). Diesel vessels of this type have been delivered under their own power by the Arctic route to the Ob', Yenisey, Lena, and Pechora rivers.



BOR-450 Screw-Driven Steam Tug, Capacity 450 Indicated Horsepower

This tug is a lake-river steamship with the possibility of operation in some maritime roadsteads. It can navigate in light ice and force light ice cover.

The ships of the first series of this type were fitted out with two TM2 vertical, triple expansion steam engines with sliding valve steam distribution and link gear. One engine is right operating, the other left. The engines operate at a steam temperature of 300 degrees and a steam pressure of 16 atmospheres. Depending on cylinder volume, the engines develop from 200 to 250 indicated horsepower at 200 revolutions per minute.

The tugs carry a KV5 water tube boiler, operating on coal, which is a vertical, symmetrical, and triangular type with a heating surface of 160 square meters, steam pressure of 16 atmospheres, and steam temperature of 300 degrees. The vessel is driven by two steel propellers (1.8 meters in diameter) working in directional cowls.

The framing system in the welded hull is transverse with floors at each frame.

The stability and hull strength of the ship fulfill the requirements for tugs of Division Na of the Register, USSR.

Dockside and running tests of the prototype tug Georgiy Sedov in the Rybinsk Reservoir verify the vessel's high operational qualities and maneuverability.

At a capacity of 475 indicated horsepower, the pull on the hook under way at a speed of 9 kilometers per hour was 6,080 kilograms.

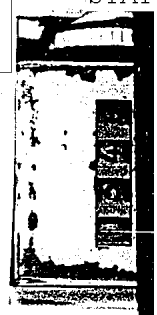
The net pull at a speed of 8 kilometers per hour was 12.8 kilograms per indicated horsepower (in place of 12.5 kilograms per indicated horsepower as designed). During running trials of the second ship, the Semen Dezhnev, the net pull on the hook at a speed of 8 kilometers per hour was 13 kilograms (in place of 12.5).

The auxiliary deck machinery on the ship is electric. On tugs launched in 1953, electric towing winches will be installed. At present, a design is being worked out for new steam boilers and engines to be installed on later tugs in this same series.

The design of the BOR-450 is to be further modernized with respect to the power installation. Boilers and engines of the new models will not change the dimensions, construction, and general plan of the ship. Modernization of the main engines will be completed in two steps:

First, new MP10 engines will replace the present triple expansion type, which will increase the capacity of the installation about 35 percent with existing boilers. With this alternation, the BOR-450 will be converted to the BOR-600 with a significant increase in towing power and reduction in net expenditure of fuel.

The second stage in the modernization of the tug is the installation of equipment for higher steam parameters with pressures from 25 to 28 atmospheres and steam temperature to 390 degrees. This change will be effected by the installation of modern KV-5M steam boilers with increased pressures which permit a further reduction in fuel expenditure per indicated horsepower. There is also in view the installation of another type of steam boiler, which has already been built and tested. This boiler uses increased steam pressure which could increase the installation's capacity up to 800 indicated horsepower while retaining the same hull and crew.



For later ships, it is planned to use the high speed MP30 engine, test models of which were built in 1954.

Thus, using the same hull, tugs of three types may be built with capacities of 450, 600, or 700-800 indicated horsepower.

Twin-Screw Diesel Lake Tug, Capacity 800 Brake Horsepower

This tug is designed for transit towing of unrigged ships in reservoirs. It is carried in Division O of the Register, USSR. With weather limitations, it can participate in coastal navigation on maritime lines.

This ship is driven by two steel propellers in propeller cowls. It carries a crew of 23 men, including seven officers. Hull reinforcing in the bow and over-all strength permit the vessel to operate during spring breakup in light ice.

The main engines of the vessel are four-cycle, solid injection, nonreversing diesels of right and left revolution with reverse-reducer transmission. The engines can be operated from three points: from the wheelhouse, the captain's bridge, and the engine room.

The vessel is equipped with three balanced rudders which are operated electrically.

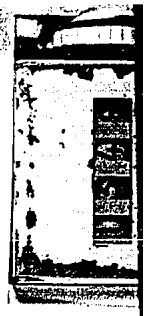
Miscellaneous Tugs

In addition to the tugs mentioned above, note should be taken of the lake-river single-screw steam tugs BOR-200. These tugs are designed for operations in large lakes and reservoirs with the ability to go out into the mouth of large rivers. As on the tugs BOR-450, the engine MP10 with a capacity of 200-300 indicated horsepower is to be installed on the BOR-200 tugs and modernization of the boilers is to be carried out with a water tube boiler having a heating surface of 85 square meters and increased steam pressure.

PUSHER TUGS

The first prototype pusher tug with a capacity of 150 brake horsepower was built in 1951 and showed excellent operational results. In addition to existing river diesel vessels with screw drive and a capacity of 300 horsepower employing two 3D6 engines, new lake pusher tugs with these same engines have been designed and construction has begun for simultaneous service as towing tugs and pushing tugs. The basic characteristics of these pusher tugs are as follows:

Index	150-hp Pusher	300-hp Lake Diesel Pusher
Length over-all (meters)	11.0	28.5
Length between perpendiculars (meters)	10.5	27.0
Maximum breadth (meters)	3.8	6.4
Molded breadth (meters)	3.5	6.0
Depth (meters)	1.65	2.5
Mean draft with full fuel load (meters)	1.11	1.51
Main engine capacity (hp)	150	2 x 150
Planned towing force at hook (kg) (at speed of 8 km/hr)	1,800	3,750
No in crew	3	11



Pusher Tug, Capacity 150 Brake Horsepower

This pusher tug was designed according to the suggestions of Engineers N. M. Turkov and N. S. Potapov and built at the Moscow Shipbuilding Yard.

The pusher tug has a 3D6 engine with a capacity of 150 brake horsepower and is driven by a four-bladed steel propellor working in a turning cowl.

The propellor cowl is now being widely adopted in shipbuilding. Utilizing the water stream from the propeller, it increases the efficiency of the propeller and the towing strength of the vessel. The turning cowl receives the propeller water stream and turns the vessel as though under the action of a rudder. The advantage of the turning cowl is that it can turn the vessel while standing still as well as when moving forward or astern.

At a speed of 9 kilometers per hour, the vessel develops a pull at the hook of 1,950 kilograms. The stability of the vessel satisfies the requirements of Division R of the Register, USSR. The hull is made up according to a transverse framing system with floors at each frame. Centralized engine control is installed in the wheelhouse for improving the ship's maneuverability.

Screw-Driven Lake Diesel Tug, Capacity 300 Brake Horsepower

This vessel uses two 3D6 engines, of 150 brake horsepower each, as main engines.

The bow of the tug is wedge-shaped with an icebreaker-type stem.

An installation is planned for the ship in order that it can operate as a pusher-tug. Since the usual rudder installation is not satisfactory for use on pusher tugs, this vessel carries two steel four-bladed screws operating in turning cowls.

Design calculations indicate that operating as a towboat, the vessel develops pulling strength of 3,750 kilograms at a speed of 8 kilometers per hour, while working as a pusher at the same speed it will develop 4,670 kilograms.

The design also includes a variant stern shape for the installation of fixed, nonturning propeller cowls. The vessel's stability and its hull strength meet the requirements of Division O of the Register, USSR.

The hull frames and plating are strengthened for navigation in light ice.

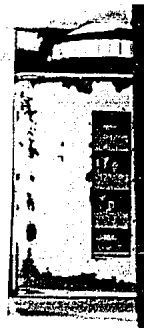
For electric current, the ship is fitted with generators operating on a 3D6 engine; in addition, there is an independent 20-horsepower engine with separate generator.

Miscellaneous Pusher Tugs

In addition to the pusher tugs of 150 and 300 horsepower described above, a pusher tug of 450 horsepower has also been designed, using three 3D6 engines, as well as a pusher tug of 600 horsepower employing two 3D12 engines of 300 horsepower each.

SELF-PROPELLED CARGO SHIPS

Self-propelled cargo ships hold a particularly important part in the river fleet, since they permit delivery of cargo with increased speed. Series production of 2,000-ton-dead-weight dry-cargo diesel vessels began in 1948, and series production of 1,000-ton-dead-weight cargo diesel vessels began in 1951.



The following table gives the basic characteristics of these two types of cargo diesel vessels.

Index	Dead Weight (tons) 2,000	1,000
Length over-all (meters)	93.2	80.4
Length between perpendiculars (meters)	90.0	75.0
Molded breadth (meters)	13.0	11.0
Depth amidships (meters)	4.8	3.5
Mean draft loaded (meters)	2.8	2.2
Dead weight (tons)	2,000	1,000
Main engine capacity (hp)	400 x 2 = 800	400 x 2 = 800
Speed fully loaded in deep water (km/hr)	14.5	16.0
No in crew	21	21

Cargo Diesel Vessel, Dead Weight 2,000 Tons

The hull of this diesel vessel is made with a double bottom, which significantly increases the longitudinal strength. The metal hull of the ship has a longitudinal system of framing along the bottom and double bottom throughout the length of the cargo holds, as well as in the side sections of deck at the bottom from the forepeak to the afterpeak. The sides and the engine room framing system is transverse. The vessel's hull is all welded and is built from semienclosed and enclosed sections. Because of the absence of longitudinal bulkheads, the cargo holds have a width of 13 meters.

The ship has four cargo hatches 6 meters wide and 9-12.6 meters long, with 600-millimeter-high coaming.

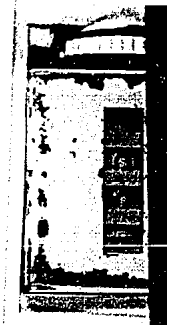
The ship is powered by two 400-horsepower engines. All auxiliary machinery is electrified.

A single metal superstructure is located aft in which all living, service, and work areas are located.

This dry-cargo diesel vessel is the most powerful and fastest of all existing in the USSR of this type and dead weight. Operational experience of cargo diesel vessels of the Bol'shaya Volga series (so-called after the prototype built in 1948) shows high operational qualities both for speed of cargo delivery and maneuverability. The designers of the Central Design Bureau of the Krasnoye Sormovo plant imeni A. A. Zhdanov (chief designer, V. M. Kerichev) were entirely successful in designing this vessel.

Cargo Diesel Vessel, Dead Weight 1,000 Tons

These vessels, with a deadweight of 1,000 tons, were basically designed for operating on rivers with fast current, such as the Yenisey and the Lena. As a result of this, the vessel is powered by two 400-brake-horsepower engines, even though its dead weight is less than the vessel previously described.



The hull of the ship is flat-bottomed, with vertical sides, and rounded bilges. The vessel has double bottoms and double sides which compensate for the absence of transverse bulkheads. Transverse bulkheads are used only in the side and bottom compartments.

The hull of the vessel is open, i.e., undecked; therefore, transverse beams at deck level are used to maintain transverse hull strength with connections by reinforcing stanchions connected to the double bottom.

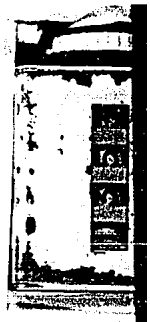
The hull framing system is transverse; to permit the vessel to operate in light ice, the frame spacing at the bow is reduced to 400 millimeters, in place of 600 millimeters as it is amidships, and an ice belt of reinforced plating is installed.

All auxiliary machinery is electrified.

UNRIGGED CARGO SHIPS (BARGES)

The basic characteristics of unrigged cargo ships (barges) are given in the following table:

Index	Decked Barges	Open Barges		Platform Barges			Tent Barges
	3,000 Tons	1,800 Tons	3,000 Tons	500 Tons	800 Tons	1,000 Tons	1,000 Tons
Length between perpendiculars (meters)	85.0	75.0	85.0	63.6	64.8	67.8	75.0
Molded breadth (meters)	14.5	13.0	14.0	10.0	14.0	14.0	15.0
Depth amidships (meters)	3.7	3.5	5.2	2.0	2.0	2.0	2.0
Mean draft loaded (meters)	3.05	2.5	3.2	1.1	1.2	1.5	1.3
Dead weight (tons)	3,000	1,800	3,000	450-500	800	1,000	1,000
Light displacement (tons/meter)	327	305	380	117	171	176	235



Decked Barges, Dead Weight 3,000 Tons

These barges have been built in very large series and are at present the basic type of transit dry-cargo barge on the Volga River. For operation in reservoir conditions, the barges will have an increased freeboard to allow for wave conditions which will be encountered there.

Capacity of the cargo holds for bulk cargo is about 3,600 cubic meters and for timber cargo it is about 3,160 cubic meters.

The hull framing system is transverse. The strength of the barge, designed and built for river navigation, is somewhat lower than the requirements of the Register, USSR, for Division O.

Dry-Cargo Open Barges, Dead Weight 1,800 and 3,000 Tons

Series construction of this new-type barge has begun for transport of dry cargo. Two variants of the vessel are under construction, having dead weight of 1,800 and 3.000 tons.

The special feature of these barges is the open cargo hold throughout the length of the vessel. The barges have double bottoms and double sides which provide the necessary hull strength for navigation in reservoirs and lakes and permit the exclusion of transverse bulkheads.

These barges are planned for transport of bulk cargoes of all categories along the basic water routes, including large reservoirs.

Platform Barges

Platform barges are in operation at present in many river basins for the transport of cargo on deck. In present usage they carry bulk cargoes, such as coal, ore, construction materials, and machine equipment, which are not subject to moisture damage.

These vessels, of various capacities, are built at a number of plants by the series-position method, using standard assemblies and sections.

These barges have a comparatively wide beam and therefore a large deck-load area. This area is kept clear by placing all superstructure at the stern.

Platform barges are built for operations on rivers and canals and belong to Division R of the Register USSR. With some reinforcing, they could be used for reservoir operations during quiet weather.

At present, series produced platform-barges are built with dead weights of 300, 450, 600, 800, 1,000, and 1,400 tons.

Tent Barges

At present, considerable numbers of 1,000-ton-dead-weight tent barges are in use for transport of grain and general cargo subject to moisture damage. These barges have 900-millimeter-high double bottoms and double sides.

The enclosures on these tent barges are made of 1.5-millimeter-thick corrugated galvanized iron and are 2.6 meters high.

The barge housing has four 4.2-meter-wide doors on each side and there are four 3.25-x-6-meter hatches in the roof. Crew quarters are located in the stern housing.

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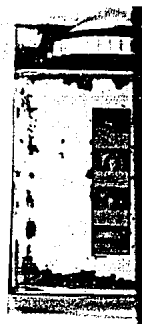

Tanker Barges

Large-series petroleum barges with dead-weight of 2,000, 3,700, 4,000, and 6,000 tons are being produced for petroleum transport. These barges are of all-welded construction, and for increased hull strength they use a longitudinal system of flat and enclosed sections.

The new tanker barges are planned for use in transporting different types of petroleum products, from aviation gasoline to viscous mazut. The barges have a pipe loading system which can handle cargo up to 2,000 tons per hour. A special pipe system is installed for hold cleaning.

Basic hull dimensions for the tanker barges are as follows:

Dimension	Dead Weight (tons)		
	2,000	4,000	6,000
Length between perpendiculars	100	108.6	133.2
Molded breadth	16.0	16.0	19.0
Depth	2.0	3.35	3.6
Loaded draft	1.7	2.85	2.7

With some decrease in dead weight (to increase freeboard), these vessels can be utilized for reservoir service.

River Icebreakers

River icebreakers were designed with the aim of hastening ice break-up in rivers and lengthening the navigation season. In accordance with these designs, two icebreakers, the Volga and the Don, were built and put into operation. Propeller cowls could be installed on these ships to increase their power and enable them to operate as tugs during the summer season.

Two direct-current electric motors are installed on these vessels as propelling machinery. All auxiliary machinery and equipment on the ships is electrically driven.

The Volga and the Don went into operation on the Volga River in 1951.

In addition to these special river tugs, icebreaker-type tugs have also been built for river fleet. These ships have reinforced framing, especially in the bow. These tugs are designed to work with icebreakers or in thin ice.

One of them, the 600-horsepower Kalashnikov, went into operation in the winter of 1952-1953.

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